

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

MATERIAL SPECIFICATION

MS-222: “HDPE and LLDPE FLEXIBLE MEMBRANE LINER”

222.1 SCOPE

This specification covers the quality of High Density Polyethylene (HDPE) and Low Linear Density Polyethylene (LLDPE) flexible liner, seams, gaskets, metal battens, embed channels, clamps, and sealant.

222.2 MATERIAL

Liner—The HDPE or LLDPE liner shall have a nominal thickness of 30 mils, 40 mils, or 60 mils as specified. The liner shall be manufactured to be suitable for use in either exposed or buried conditions. It shall conform to the requirements of this specification as shown in tables 222–1 through 222–4. It shall also meet the requirements shown on the drawings.

Gaskets, metal battens, clamps, embed channels, and sealant—Gasket material shall be neoprene, closed cell medium, 0.25 inch thick, with adhesive on one side, or other gasket material as approved by the liner manufacturer. Metal battens shall be 0.25 inch thick by 2 inches wide stainless steel. Clamps shall be 0.5-inch-wide stainless steel. Embed channel shall have the same properties as the liner. Sealant shall be General Electric Silicone, RTV 103, or equivalent.

222.3 HDPE and LLDPE liner properties

The HDPE or LLDPE liner shall be manufactured from virgin polymer material and shall meet the property values specified under tables 222–1 through 222–4 as applicable.

Table 222-1 Requirements for smooth HPDE liner

Property	Test methods	Requirements*		
		----- nominal thickness -----		
		30 mil	40 mil	60 mil
Density, g/cc	ASTM D 1505	0.940	0.940	0.940
Tensile properties	ASTM D 638 (type IV at 2 in/min)			
yield stress, lb/in		63	84	126
break stress, lb/in		114	152	228
yield elongation, %		12	12	12
break elongation, %		560	560	560
Tear resistance, lb	ASTM D 1004	21	28	42
Puncture resistance, lb	ASTM D 4833	54	72	108
Carbon black content, %	ASTM D 1603	2-3	2-3	2-3
Carbon black dispersion	ASTM D 5596	Cat 1-2	Cat 1-2	Cat 1-2
Seam properties	ASTM D 4437 (1 in wide at 2 in/min)			
shear strength, lb/in		60	80	120
peel strength, lb/in**		39/FTB	52/FTB	78/FTB

* All values, unless specified otherwise, are minimum average roll values as reported for the test method.

** Film tear bond: A failure of one of the bonded sheets by tearing prior to complete separation in the bonded area.

Table 222-2 Requirements for textured HPDE liner

Property	Test methods	Requirements*		
		----- nominal thickness -----		
		30 mil	40 mil	60 mil
Density, g/cc	ASTM D 1505	0.940	0.940	0.940
Tensile Properties	ASTM D 638 (type IV at 2 in/min)			
yield stress, lb/in		63	84	126
break stress, lb/in		45	60	90
yield elongation, %		12	12	12
break elongation, %		100	100	100
Tear resistance, lb	ASTM D 1004	21	28	42
Puncture resistance, lb	ASTM D 4833	45	60	90
Carbon black content, %	ASTM D 1603	2 - 3	2 - 3	2 - 3
Carbon black dispersion	ASTM D 5596	Cat 1-2	Cat 1-2	Cat 1-2
Seam properties	ASTM D 4437 (1 in wide at 2 in/min)			
shear strength, lb/in		60	80	120
peel strength, lb/in**		39/FTB	52/FTB	78/FTB

* All values, unless specified otherwise, are minimum average roll values as reported by the specified test methods.

** Film tear bond: A failure of one of the bonded sheets by tearing prior to complete separation in the bonded area.

Table 222-3 Requirements for smooth LLDPE liner

Property	Test methods	Requirements*		
		----- nominal thickness -----		
		30 mil	40 mil	60 mil
Density, g/cc	ASTM D 1505	0.915	0.915	0.915
Tensile properties	ASTM D 638 (type IV at 2 in/min)			
yield stress, lb/in		45	60	94
break stress, lb/in		128	170	255
yield elongation, %		13	13	13
break elongation, %		800	800	800
Tear resistance, lb	ASTM D 1004	17	22	33
Puncture resistance, lb	ASTM D 4833	51	68	102
Carbon black content, %	ASTM D 1603	2-3	2-3	2-3
Carbon black dispersion, %	ASTM D 5596	Cat 1-2	Cat 1-2	Cat 1-2
Seam properties	ASTM D 4437 (1 in wide at 2 in/min)			
shear strength, lb/in		44	58	90
peel strength, lb/in		37/FTB**	50/FTB	90/FTB

* All values, unless otherwise specified, are minimum average roll values as reported for each test method

** Film tear bond: A failure of one of the bonded sheets by tearing prior to complete separation in the bonded area.

Table 222-4 Requirements for textured LLDPE liner

Property	Test methods	Requirements*		
		----- nominal thickness -----		
		30 mil	40 mil	60 mil
Density, g/cc	ASTM D 1505	0.915	0.915	0.915
Tensile properties	ASTM D 638 (type IV at 2 in/min)			
yield stress, lb/in		44	58	87
break stress, lb/in		60	80	120
yield elongation, %		13	13	13
break elongation, %		350	350	350
Tear resistance, lb	ASTM D 1004	17	23	35
Puncture resistance, lb	ASTM D 4833	51	68	102
Carbon black content, %	ASTM D 1603	2-3	2-3	2-3
Carbon black dispersion, %	ASTM D 5596	Cat 1-2	Cat 1-2	Cat 1-2
Seam properties	ASTM D 4437 (1 in wide at 2 in/min)			
shear strength, lb/in		40	53	79
peel strength, lb/in		33/FTB**	44/FTB	66/FTB

* All values, unless otherwise specified, are minimum average roll values as reported for each test method

** Film tear bond: A failure of one of the bonded sheets by tearing prior to complete separation in the bonded area.